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BIOLOGICAL
EVALUATION R4-80-5

WESTERN SPRUCE BUDWORM CONDITIONS
1979

Forest Insect and Disease Management
State and Private Forestry
Intermountain Region
USDA-Forest Service

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WESTERN SPRUCE BUDWORM CONDITIONS

REGION 4

1979

ABSTRACT

During July, August, and September 1979, aerial surveys of the Region's National Forests were made to map areas of western spruce budworm defoliation. Visible defoliation was categorized as light, moderate, or heavy. The Idaho Primitive area and other portions of National Forests which have been recommended for wilderness classification were not flown. A decrease in budworm defoliation was observed on the Boise, Bridger-Teton and Payette National Forests. However, if unflown portions of the Primitive area and recommended wilderness areas were to have been included, the overall acreage would have exceeded 1978 defoliation figures.

Western spruce budworm populations remained at high levels in Region 4 Forests where host type on over 1.1 million acres were defoliated in 1979. Top killing and understory mortality is increasing on the Salmon and Targhee National Forests, and in Grand Teton National Park. Egg mass surveys indicate budworm populations will continue at moderate to high levels during the 1980 field season on the remaining Forests supporting budworm populations.

The Idaho Department of Lands operationally sprayed 139,000 acres of federal, state and private lands. No operational spray projects are planned in Region 4 for 1980.

INTRODUCTION

The western spruce budworm is a native pest of North American conifers with damage having been recorded since the late 1800s. In the Intermountain Region the first outbreak was recorded in southern Idaho in 1922, when western spruce budworm was reported on several National Forests. In 1954 aerial detection/surveillance programs were initiated in the Intermountain Region. Budworm activity since that time has occurred on an annual basis in areas of the Region. Infestation levels have been observed to fluctuate from a few thousand acres to in excess of two million acres on a somewhat periodic basis. Widespread epidemics were observed during the 1950s, early 1960s, and again in the 1970s. In the northern Rocky Mountains, outbreaks usually last from one to five years, but occasionally extend to fifteen years. In the Intermountain Region where five National Forests and Grand Teton National Park currently experience budworm activity, infestations generally last about nine years.

Suppression activities were first undertaken in the Intermountain Region in 1955 when approximately 840,000 acres were aerially sprayed with DDT. Other large-scale spray operations followed in 1956, '57, '63 and '64. In 1965 a large suppression project was cancelled when unseasonable spring freezes caused severe larval mortality. From 1964 until 1979, no suppression projects were conducted.

This report is intended to bring resource managers up-to-date on western spruce budworm infestations as they occur throughout Forest Service, Region 4.

BIOLOGICAL INFORMATION

Insect

Western spruce budworm, Choristoneura occidentalis Freeman.

Host Trees

Grand fir, Abies grandis (Dougl.) Lindl.

Subalpine fir, Abies lasiocarpa (Hook.) Nutt.

Douglas-fir, Pseudotsuga menziesii var. glauca (Beisnn.) France.

Engelmann spruce, Picea engelmanni Parry.

Western larch, Larix occidentalis Nutt.

In order of preference, budworm larvae defoliate grand fir, subalpine fir, Douglas-fir, Engelmann spruce and western larch.

Life History

Budworm moths (adults) emerge from pupal cases during mid-July through August. They are predominately mottled orange brown in color and have a wing spread of 22-28mm. Light green colored eggs are laid by the female moths in shingle-like masses on the undersides of current year needles in late July and August. Eggs hatch in about 10 days. Emerging larvae (first instar) are light green with brown heads. First instar larvae do not feed but spin silken shelters among lichens and under bark scales where they overwinter. The following spring these larvae mine previous years' needles progressing through the second and third instar stages until buds swell. They bore into the buds and feed upon the growing needles and feed on the new growth. Larvae mature into the sixth instar during late June and early July. They are 25-32mm long, and have a brownish head and body with prominent ivory colored spots. Mature larvae pupate in late June and early July.

Damage

The majority of the Region's western spruce budworm infestations have been in progress for five or more years. In some cases stands have been undergoing defoliation for over a decade with the result that host species are suffering top kill, reduced growth increment, interruption of cone production and some mortality to reproduction.

Site Associations

A review of the 1977, 1978, and 1979 field data indicates heaviest damage is occurring in the grand fir habitat types. The specific habitat types in which grand fir has suffered the greatest damage was grand fir/western gold thread, and grand fir/queen cup bead lily. Two other grand fir habitat types where budworm was somewhat less active were the grand fir/twin flower and grand fir/mountain maple. In the drier grand fir/blue huckleberry habitat type, only moderate levels of mortality and top kill have been observed (Steele et al. 1975).

LOCATION AND STATUS OF INFESTATIONS

Aerial Sketch-Map Survey

Visual defoliation was aerially sketch mapped during July, August, and early September of 1979. Defoliation intensity by acres are summarized for each forest, Table 1.

Table 1. Visible defoliation by western spruce budworm in the Intermountain Region during 1979.

DEFOLIATION INTENSITY (ACRES)					
Area	Light	Moderate	Heavy	Total	Inc. + Dec. -
Boise NF	44,800	36,100	66,500	147,400	-
Bridger-Teton NF	38,300	73,900	34,800	147,000	-
Grand Teton NF	7,100	3,600	1,800	12,500	+
Payette NF	46,400	52,900	176,200	275,500	-
Salmon NF	91,800	99,800	153,00	344,600	+
Targhee NF	38,900	79,000	88,800	206,700	+
TOTAL	267,300	345,300	521,100	1,133,700	

The above figures do not include 139,000 acres that were operationally sprayed in 1979. Treated stands were on federal, state, and private lands. Portions of two National Forests, the Boise and Payette were sprayed to provide buffer zones for adjacent state and private lands.

Following is a description by respective Forests of the location and status of western spruce budworm infestations. These areas are depicted in Appendix B.

Boise National Forest

New areas of light defoliation on the Boise National Forest were found in Canyon Creek south of Bull Trout, along the upper reaches of tributaries to Deadwood River, and in the Monumental Peak area. On West Mountain chronic infestations continued with defoliation classed as heavy. New areas of light and moderate defoliation were recorded along the North Fork of the Payette River from the old Ferncroft Lodge area west to Fletcher Butte, and north to western portions of High Valley. Moderate to heavy defoliation occurred in Upper Squaw Creek and south of Sage Hen Reservoir toward Pine Creek Meadow. Heavy defoliation was observed north of Sage Hen Reservoir from Hen Creek through the Rammage Meadows area.

Bridger-Teton National Forest

Budworm defoliation on the Bridger-Teton National Forest decreased approximately 50,000 acres from 1978 to 1979, with the most notable decline occurring in Cliff Creek and its tributaries. Some increase in defoliation intensity occurred north of the Wilson Victor Highway extending into Grand Teton National Park as far north as Moran Bay. Expansions of budworm defoliation occurred southwest of the Gros Ventre slide near the boundary of the Bridger-Teton National Forest and the National Elk Refuge. The eastern portion, or Wind River Division of the Bridger-Teton, was not aerially surveyed.

Payette National Forest

Overall, the budworm infestations on the Payette National Forest decreased by 33,400 acres from 1978 to 1979. Some changes in defoliation intensity were noted primarily to the west of Payette Lake where infestations have shifted from heavy to moderate. In the Indian, Bear, and Lick Creek areas on the west side of the Forest, budworm activity increased from moderate to heavy defoliation. Areas heavily defoliated in 1978 along the South Fork of the Salmon River from Fitsum Creek south to White Rock Peak receded slightly in 1979. Increases in light defoliation were noted from Anderson Creek and Wolfe Creek south to the Valley/Adams County line. Small spot infestations on the west side of the Little Salmon River were noted in Middle Mud Creek, Main Mud Creek, Ant Basin, Yellowjacket and North Star Creek.

Salmon National Forest

Budworm infestations on the Salmon National Forest continue to increase in size and intensity of defoliation. Defoliation was heavy on the north side of the Main Salmon River and the area east of North Fork to Carmen Creek. The most dramatic increase in budworm activity occurred from Sheep Creek southeast to Carmen Creek. In this area several thousand acres of heavy budworm defoliation was observed in 1979. Only a few hundred acres of light to moderate defoliation was recorded in the same general area in 1978. Defoliation continues to expand onto the south side of the Main Salmon River and in Panther Creek and its drainages southward past Cobalt, Idaho. New areas of light to moderate defoliation west of Salmon, Idaho from Jesse Creek north to North Fork, Idaho were recorded. The budworm has been absent from these areas since the spring of 1965 when unseasonable freezes caused massive mortality to early instar budworm populations.

Targhee National Forest

On the Targhee National Forest budworm defoliation expanded on an additional 100,000 acres in 1979. Heavy defoliation continued north of Spencer, Idaho with extensions east to the east fork of Camas Creek. The persistent infestation west of Henrys Lake remained static; moderate and heavy defoliation in the Hole Mountain areas west of Driggs, Idaho increased in size and intensity. New areas of light to moderate defoliation occurred east of Driggs in Game and Moose Creeks and along both sides of the Victor-Jackson Highway. High elevation (above 8,000 feet) infestations of light to moderate defoliation were mapped in the headwaters of Palisades and Big Elk Creeks. Persistent infestations along the Grand Canyon of the Snake from Alpine Junction to Hoback Junction showed moderate to heavy defoliation. Expansion of budworm activity on portions of the Caribou Forest administered by the Targhee, southwest of Palisades Reservoir, encompassed several thousand acres of light, moderate, and heavy defoliation.

Grand Teton National Park

In Grand Teton National Park, heavy infestations continued on Blacktail Butte. New areas of light to moderate defoliation occurred along the western side of Phelps Lake north to Moran Bay. This area showed a 9,300 acre increase over defoliation observed in 1978.

Other Areas

Budworm infested areas in the Idaho Primitive Area were not flown in 1979, therefore no acreage data is available. However, relatively high levels of budworm activity were observed along the Middle Fork and Main Salmon River on the Payette, Salmon, and Challis National Forest portions of the Idaho Primitive Area. As a point of interest, in excess of 60,000 acres of budworm infested Douglas-fir and true firs were destroyed in the Mortar Creek fire which swept through portions of Idaho Primitive Area during July and August, 1979.

Egg Mass Surveys

During 1979, an array of 293 sample plots on 13 entomological units were sampled in September to count numbers of egg masses. Sampling was done on five National Forests; Boise, Bridger-Teton, Payette, Salmon and Targhee. Egg mass density data was used for predicting percent defoliation in 1980 (Table 2).

Entomological units were established for egg mass sampling using the following criteria.

1. Areas must be currently defoliated or have a recent history of spruce budworm defoliation.

2. Entomological units were established wherever similar contiguous host types occurred.

3. Due to the diversity in western mountainous terrain, natural barriers were used to define some entomological units. Those features were:

- a. Change from host to non-host type.
- b. Major mountain ranges.
- c. Steep river canyons.
- d. Wide valleys with no host type.

An effort was made to distribute sample plots as evenly as possible over entomological units which would give results that should represent general defoliation trends for the following year, even though localized variations may occur.

Branches were carefully examined and all egg masses removed in order to check for viability, parasitism, and age.

The relationship between egg mass counts and predicted defoliation damage follows:

<u>Number of Egg Masses/3 Tree Cluster</u>	<u>Percent Predicted Defoliation</u>	<u>Defoliation Category</u>
0-2	0-25%	Light
3-6	26-40%	Moderate
7-24	41-55%	Heavy
25+	56-100%	Very Heavy

For each entomological unit number of egg masses, predicted defoliation, and defoliation categories were averaged. This information is presented in Appendix A.

The following information has been compiled into predicted defoliation for 1980 on each of the Forests incurring populations of western spruce budworm. Results are presented in Table 2.

Table 2. Predicted defoliation 1980 - Region 4.

Forest	Entomological Unit	Percent Defoliation	Damage Forecast
Boise	West Mountain	40-50	West of Cascade Reservoir medium; most of unit heavy.
Bridger-Teton	Jackson	30-50	Heavy overall, moderate in Hoback Junction area.
Targhee	Palisades Res.	30-40	Light to moderate east of Palisades Res. Moderate to heavy southwest of Palisades Reservoir.
Payette	Price Valley	25-50	Light except heavy north of Bear, Cuprum.
	New Meadows	35-50	Moderate to heavy west of Last Chance.
	Council	25-50	Moderate, scattered heavy.
	East McCall	65	Heavy throughout unit.
	Krassel - South Fork, Salmon River	20-30	Light, heavy near Secesh River.
Salmon	Salmon District	50	Moderate to heavy; Panther Cr., Cobalt area.
	North Fork District	50	Moderate to heavy north of Main Salmon River.
Targhee	Spencer	65	Heavy east and west to Continental Divide.
	Henrys Lake	30	Light to moderate west of Henrys Lake.
	Victor	50	Heavy northwest of Victor.

CONTROL ACTIVITIES

In 1979, the State of Idaho Department of Lands and Boise Cascade Corporation jointly sprayed 139,000 acres of federal, state, and private lands. Buffer areas were defined that included portions of National Forest lands on the Boise and Payette National Forests. Two chemicals, Sevin-4 oil® and Orthene®, were used during the project. Sevin-4 oil® was used in areas that required minimum stream or water protection and Orthene® was used in areas where water protection and avian considerations presented special consideration.

Detection/surveillance surveys will be made to sketch map defoliated areas and to classify defoliation intensities. These activities will provide land and resource managers with information that will assist them in making insect-related management decisions. No recommendations have been made to operationally spray budworm areas in the Region during the 1980 field season.

CONCLUSIONS

All indications are for budworm activity to remain well in excess of one million acres in 1980 barring any major adverse bioclimatic interference with populations. The Salmon and Targhee National Forests can expect further expansions and increased defoliation intensities. Older infestations (10 or more years) on the Payette National Forest should continue their slow decline. There is potential for declining trends to continue on the Boise, Bridger-Teton, and Payette National Forests. Conversely, increases can be expected on the Targhee and Salmon National Forests, and Grand Teton National Park (Knopf et al. 1979).

RECOMMENDATIONS

In order to keep resource managers currently updated on western spruce budworm infestations, it is recommended that FI&DM personnel in 1980 will: 1) Aerially survey known infestations to determine extent and intensity of defoliation. Also, aerial surveys will be conducted over non-infested host types to detect new areas of defoliation. 2) Conduct egg mass surveys from which 1981 defoliation predictions will be made.

The resource manager, wherever possible, should consider type conversion in stands with high percentages of grand fir. This host species maintains high populations of western spruce budworm which act basically as biological reservoirs.

If chemical pesticides are being considered for suppression, the land manager has two chemicals available that effectively reduce budworm populations: Orthene^R and Sevin-4 oil^R. Malathion is also registered for budworm control; however, this material has given erratic results in past suppression projects. If a suppression project is being considered, reference should be made to: "Amended Final Environmental Statement, 1979." This document would be helpful in the planning process and in preparing an EIS.

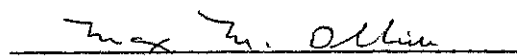
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APPENDIX A

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

BOISE NF (West Mountain) (Unit 60)

lot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Arling Trail	4	26-40	Moderate
2	Hurd Creek	6	26-40	Moderate
3	Silver Creek	0	0-25	Light
4	French Creek	5	26-40	Moderate
5	Skein Creek	11	41-55	Heavy
6	Willow Creek	2	0-25	Light
7	Lower NF Payette River	2	0-25	Light
8	Upper NF Payette River	2	0-25	Light
9	Grassy Flat	1	0-25	Light
10	Fawn Creek	No sample		
11	Boulder Creek	No sample		
12	Granite Peak	0	0-25	Light
13	Bogus	18	41-55	Heavy
14	Cabarton Road	3	26-40	Moderate
15	Tripod Creek	0	0-25	Light
16	Round Valley	1	0-25	Light
17	Murray Creek (1)	No sample		-
18	Murray Creek (2)	No sample		-
19	Destroyed by Logging		-	-
20	Cottonwood Creek	7	41-55	Heavy
21	Sage Hen	7	41-55	Heavy
22	Sage Hen Basin	No sample		-
23	Joes Creek	No sample		-
24	Antelope Swale	10	41-55	Heavy
25	Sage Hen Creek	5	26-40	Moderate
MEAN		4.5	26-40	Moderate

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

BRIDGER-TETON NF (Unit 3)

lot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Astoria Hot Springs	9	26-40	Moderate
2	Bull Hollow	20	41-55	Heavy
3	Deer Creek	11	41-55	Heavy
4	Fall Creek	6	26-40	Moderate
5	Game Creek	3	0-25	Light
6	Higby Creek	27	41-55	Heavy
7	Horse Creek	7	26-40	Moderate
8	Lower Cache Creek	3	0-25	Light
9	Lower Leeks Canyon	11	26-40	Moderate
10	Mill Creek	76	56-100	Very Heavy
11	Miller Creek	40	41-55	Heavy
12	North Fork Murphy Creek	24	41-55	Heavy
13	Palmer Creek	5	26-40	Moderate
14	Porcupine Creek	55	56-100	Very Heavy
15	Radio Point	65	56-100	Very Heavy
16	Rogers Gulch	15	41-55	Heavy
17	Roos Creek	No sample		
18	Snow King	17	41-55	Heavy
19	Squaw Creek	31	41-55	Heavy
20	Twin Creek Ranch	18	41-55	Heavy
21	Upper Cache Creek	8	26-40	Moderate
22	Upper Leeks Canyon	32	41-55	Heavy
23	Upper West Bailey Creek	27	41-55	Heavy
24	West Bailey Creek	33	41-55	Heavy
25	Willow Creek	27	41-55	Heavy
26	Wilson Canyon	41	56-100	Very Heavy
27	Berts Hollow	16	41-55	Heavy
28	Cabin Creek	1	0-25	Light
29	East Table Creek	3	0-25	Light
30	Grizzly Basin	0	0-25	Light
31	Martin Creek	5	26-40	Moderate
32	Near Dog Creek	8	26-24	Moderate
33	North Blacktail Butte	26	41-55	Heavy
34	Red Creek	5	26-40	Moderate
35	South Blacktail Butte	22	41-55	Heavy
36	Stinking Springs	20	41-55	Heavy
37	Trail Creek	42	56-100	Very Heavy
38	Upper Porcupine Creek	33	41-55	Heavy
MEAN		21.4	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

CARIBOU NF (Alpine Junction) (Unit 6)

Plot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Jensen Meadow	11	41-55	Heavy
2	Jensen Creek	28	41-55	Heavy
3	Poker Peak	18	41-55	Heavy
4	Sulphur Bar Trail	18	41-55	Heavy
5	Upper Elk Creek	9	26-40	Moderate
6	Middle Elk Creek	2	0-25	Light
7	Lower West Fork Elk Creek	43	56-100	Very Heavy
8	Chicken Ridge	58	56-100	Very Heavy
9	Dry Gulch	12	41-55	Heavy
10	Cottonwood Creek	0	0-25	Light
11	Open Canyon	3	0-25	Light
12	Cabin Creek	0	0-25	Light
13	Lower North Fork Indian Creek	0	0-25	Light
14	Upper North Fork Indian Creek	13	41-55	Heavy
15	Lower South Fork Indian Creek	6	26-40	Moderate
16	Upper South Fork Indian Creek	9	26-40	Moderate
17	Lower Blowout Canyon	0	0-25	Light
18	Upper Blowout Canyon	6	26-40	Moderate
19	Tag Alder Creek	13	41-55	Heavy
20	Russell Creek	4	26-40	Moderate
21	Neswander Canyon	15	41-55	Heavy
22	Pat Canyon	36	41-55	Heavy
MEAN		13.8	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (Price Valley) (Unit 10)

lot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Horse Mountain	3	26-40	Moderate
2	Placer Basin	2	0-25	Light
3	Bear	0	0-25	Light
4	Indian Creek	16	41-55	Heavy
5	Black Lake Road	9	41-55	Heavy
6	Little Bear Creek	2	0-25	Light
7	Bear Creek	0	0-25	Light
8	No sample	-		
9	No sample	-		
10	Lick Creek	0	0-25	Light
11	Railroad Saddle	0	0-25	Light
12	East Fork Lost Creek	0	0-25	Light
13	Boulder Creek	0	0-25	Light
14	Upper Boulder Creek	2	0-25	Light
15	Twin Fork	0	0-25	Light
16	Upper Ant Basin Creek	0	0-25	Light
17	Lower Ant Basin Creek	7	41-55	Heavy
18	Yellow Jacket Creek	1	0-25	Light
19	Star Creek	0	0-25	Light
20	Bear Wallow	1	0-25	Light
21	Smokey Campground	0	0-25	Light
22	Mud Creek	0	0-25	Light
23	East Mud Creek	9	41-55	Heavy
24	East Branch Weiser River	0	0-25	Light
25	No sample			
MEAN		2.4	0-25	Light

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (New Meadows) (Unit 20)

lot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Bally Mountain	1	0-25	Light
2	Granite Mountain	10	41-55	Heavy
3	Browns Creek Rd. (1)	4	26-40	Moderate
4	Browns Creek	2	0-25	Light
5	Browns Creek Rd. (2)	4	26-40	Moderate
6	Browns Creek Rd. (3)	6	26-40	Moderate
7	Fourmile Creek	3	26-40	Moderate
8	Seawell Creek	11	41-55	Heavy
9	Threemile Creek	4	26-40	Moderate
10	Brundage Ski Area	7	41-55	Heavy
11	Last Chance Campground	0	0-25	Light
12	Goose Creek	6	26-40	Moderate
13	Thorn Creek	4	26-40	Moderate
14	Little Goose Creek	4	26-40	Moderate
15	Rock Flat	1	0-25	Light
16	Lower Bear Basin	3	26-40	Moderate
17	Upper Bear Basin	5	26-40	Moderate
18	Wagon Bay Creek	3	26-40	Moderate
19	Dead Horse Creek	0	0-25	Light
20	Box Creek	0	0-25	Light
21	Copet Creek	1	0-25	Light
22	No sample	-		
23	Fire Camp	0	0-25	Light
24	Martin Creek	2	0-25	Light
25	Brundage Mountain	12	41-55	Heavy
MEAN		4.8	26-40	Moderate

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (Council) (Unit 30)

lot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	No Business	1	0-25	Light
2	East No Business Mtn.	No sample	-	-
3	West No Business Mtn.	3	26-40	Moderate
4	Granite Creek	3	26-40	Moderate
5	North Red Ridge	5	26-40	Moderate
6	South Red Ridge	10	41-55	Heavy
7	Little Salmon River	13	41-55	Heavy
8	Beaver Creek	1	0-25	Light
9	Bluebunch Spring	11	41-55	Heavy
10	Dry Beaver Creek	3	26-40	Moderate
11	Bench Creek	8	41-55	Heavy
12	Dewey Creek	0	0-25	Light
13	Weiser River	8	41-55	Heavy
14	Big Creek	2	0-25	Light
15	Squaw Flat	0	0-25	Light
16	Lake Creek	12	41-55	Heavy
17	Crystal Creek	3	26-40	Moderate
18	Lower Little Creek	5	26-40	Moderate
19	Upper Little Creek	3	26-40	Moderate
20	Scotch Corral	9	41-55	Heavy
21	Poison Timber Point	No sample	-	-
22	Indian Mountain	3	26-40	Moderate
23	Wolf Creek	3	26-40	Moderate
24	Cold Spring Ridge	15	41-55	Heavy
25	Evans Trail	0	0-25	Light
MEAN		5.3	26-40	Moderate

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (East McCall) (Unit 40)

Plot No.	Area	No. Egg Masses / 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Granite Lake	0	0-25	Light
2	Pearl Creek	1	0-25	Light
3	Twah Creek	5	26-40	Moderate
4	Lemah Creek	7	41-55	Heavy
5	Beaverdam	4	26-40	Moderate
6	Black Lee Creek	1	0-25	Light
7	Fall Creek	14	41-55	Heavy
8	Duston Creek	0	0-25	Light
9	Jumbo Creek	16	41-55	Heavy
10	Slick Rock	No sample		
11	Boulder Creek (1)	No sample		
12	Boulder Creek (2)	10	41-55	Heavy
13	Louie Creek	0	0-25	Light
14	Upper Rapid Creek	8	41-55	Heavy
15	Paddy Creek	8	41-55	Heavy
16	Paddy Road	0	0-25	Light
17	Paddy Flat	No sample		
18	Lower Rapid Creek	25	56-100	Very Heavy
19	Kennally Creek Campground	7	41-55	Heavy
20	Kennally Creek	6	26-40	Moderate
21	Sloans Point	8	41-55	Heavy
22	Poorman Creek	9	41-55	Heavy
23	Jug Creek	No sample		
24	Powelson Creek	17	41-55	Heavy
25	Upper Paddy Road	No sample		
26	Deep Creek	2	0-25	Light
27	Gold Fork	5	26-40	Moderate
28	South Fork Gold Fork	16	41-55	Heavy
29	Grouse Creek	9	41-55	Heavy
30	Sloans Creek	12	41-55	Heavy
MEAN		7.6	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (Krassel) (Unit 50)

Plot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	China Creek	0	0-25	Light
2	K. Creek	0	0-25	Light
3	Pony Creek	1	0-25	Light
4	West K. Creek	1	0-25	Light
5	China Mountain	1	0-25	Light
6	Zena Creek (1)	22	41-55	Heavy
7	Threemile Creek	0	0-25	Light
8	Oompaul Creek	3	26-40	Moderate
9	Zena Creek (2)	3	26-40	Moderate
10	Zena Creek (3)	1	0-25	Light
11	Split Creek	1	0-25	Light
12	Steep Creek	0	0-25	Light
13	Prince Creek	2	0-25	Light
14	Hum Creek	1	0-25	Light
15	Buckhorn Creek	No sample		
16	Homedale Creek	No sample		
17	Little Buckhorn Creek	No sample		
18	Miners Peak	No sample		
19	Jackie Creek	0	0-25	Light
20	Holdover Creek	2	0-25	Light
21	Poverty Flat	0	0-25	Light
22	Bearhill Creek	4	26-40	Moderate
23	Sister Creek	0	0-25	Light
24	Goat Creek	No sample		
25	Secesh River	1	0-25	Light
MEAN		2.2	0-25	Light

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

PAYETTE NF (West Mountain) (Unit 60)

lot No.	Area	No. Egg Masses / 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Arling Trail	4	26-40	Moderate
2	Hurd Creek	6	26-40	Moderate
3	Silver Creek	0	0-25	Light
4	French Creek	5	26-40	Moderate
5	Skein Creek	11	41-55	Heavy
6	Willow Creek	2	0-25	Light
7	Lower NF Payette River	2	0-25	Light
8	Upper NF Payette River	2	0-25	Light
9	Grassy Flat	1	0-25	Light
10	Fawn Creek	No sample		
11	Boulder Creek	No sample		
12	Granite Peak	0	0-25	Light
13	Bogus	18	41-55	Heavy
14	Cabarton Road	3	26-40	Moderate
15	Tripod Creek	0	0-25	Light
16	Round Valley	1	0-25	Light
17	Murray Creek (1)	No sample		-
18	Murray Creek (2)	No sample		-
19	Destroyed by Logging		-	-
20	Cottonwood Creek	7	41-55	Heavy
21	Sage Hen	7	41-55	Heavy
22	Sage Hen Basin	No sample		-
23	Joes Creek	No sample		-
24	Antelope Swale	10	41-55	Heavy
25	Sage Hen Creek	5	26-40	Moderate
MEAN		4.5	26-40	Moderate

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

SALMON NF (West of Salmon) (Unit 04)

Plot No.	Area	No. Egg Masses / 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Bob Moore Creek	2	0-25	Light
2	Diamond Creek	2	0-25	Light
3	Gorley Creek	No sample		
4	Ludwig Gulch	45	56-100	Very Heavy
5	Moyer Creek	6	26-40	Moderate
6	Musgrove Creek Mine	No sample		
7	Musgrove Ranch	8	26-40	Moderate
8	Napias Creek	20	41-55	Heavy
9	Porphyry Creek	6	26-40	Moderate
10	Quartzite Mountain	1	0-25	Light
11	Red Rock Road	5	26-40	Moderate
12	Shovel Creek	1	0-25	Light
13	Spring Creek	110	56-100	Very Heavy
14	South Fork Porphyry Creek	8	26-40	Moderate
15	South Fork Williams Creek	20	41-55	Heavy
16	Upper Shovel Creek	9	26-40	Moderate
17	Upper South Fork Porphyry Creek	12	41-55	Heavy
18	Williams Creek	14	41-55	Heavy
19	Yellowjacket Guard Station	6	26-40	Moderate
MEAN		16.1	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

SALMON NF (North Fork) (Unit 80)

Plot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	State Creek	16	41-55	Heavy
2	Vine Creek	26	41-55	Heavy
3	Twin Creek	7	26-40	Moderate
4	Continental Divide	4	26-40	Moderate
5	Nez Perce Creek	4	26-40	Moderate
6	Threemile Creek	4	26-40	Moderate
7	Smithy Creek	8	26-40	Moderate
8	Salzer Creek	12	41-55	Heavy
9	Allan Creek	19	41-55	Heavy
10	West Fork Hughes Creek	53	56-100	Very Heavy
11	Bear Gulch	40	41-55	Heavy
12	Grouse Gulch	8	26-40	Moderate
13	Burnt Gulch	14	41-55	Heavy
14	Box Spring	90	56-100	Very Heavy
15	Hull Creek	9	26-40	Moderate
16	Spruce Gulch	30	41-55	Heavy
17	West Fork Hall Creek	39	41-55	Heavy
18	Lower Indian Creek	23	41-55	Heavy
19	Upper Indian Creek	28	41-55	Heavy
20	Squaw Creek	23	41-55	Heavy
MEAN		22.8	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

TARGHEE NF (West Division) (Unit 1)

lot No.	Area	No. Egg Masses	Predicted Defoliation (%) 1980	Defoliation Category
1	Allan Canyon	22	41-55	Heavy
2	Beacon Springs	49	56-100	Very Heavy
3	Bear Trap Creek	0	0-25	Light
4	Corral Creek	7	26-40	Moderate
5	Cottonwood Creek	1	0-25	Light
6	East Dairy Creek	82	56-100	Very Heavy
7	East Threemile Creek	33	41-55	Heavy
8	Little Creek	0	0-25	Light
9	McGarry Canyon	18	41-55	Heavy
10	Northeast Miners Creek	13	41-55	Heavy
11	Northeast Spring Creek	12	41-55	Heavy
12	Petes Creek	3	0-25	Light
13	Picnic Hollow	11	41-55	Heavy
14	Pleasant Valley Creek	41	56-100	Very Heavy
15	Pocatello Butte	76	56-100	Very Heavy
16	Polks Pit	36	41-55	Heavy
17	Porcupine Pass	20	41-55	Heavy
18	Saw Creek	1	0-25	Light
19	Spring Creek Ridge	68	56-100	Very Heavy
20	Stoddard Creek	13	41-55	Heavy
21	Threemile Creek	24	41-55	Heavy
22	Upper Little Creek	0	0-25	Light
23	Van Noy Canyon	9	26-40	Moderate
24	West Camas Creek	No sample		-
25	West Dairy Creek	32	41-55	Heavy
26	West Dry Creek	No sample		
27	White Pine Canyon	73	56-100	Very Heavy
MEAN		25.8	41-55	Heavy

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

TARGHEE NF (Henry's Lake) (Unit 2)

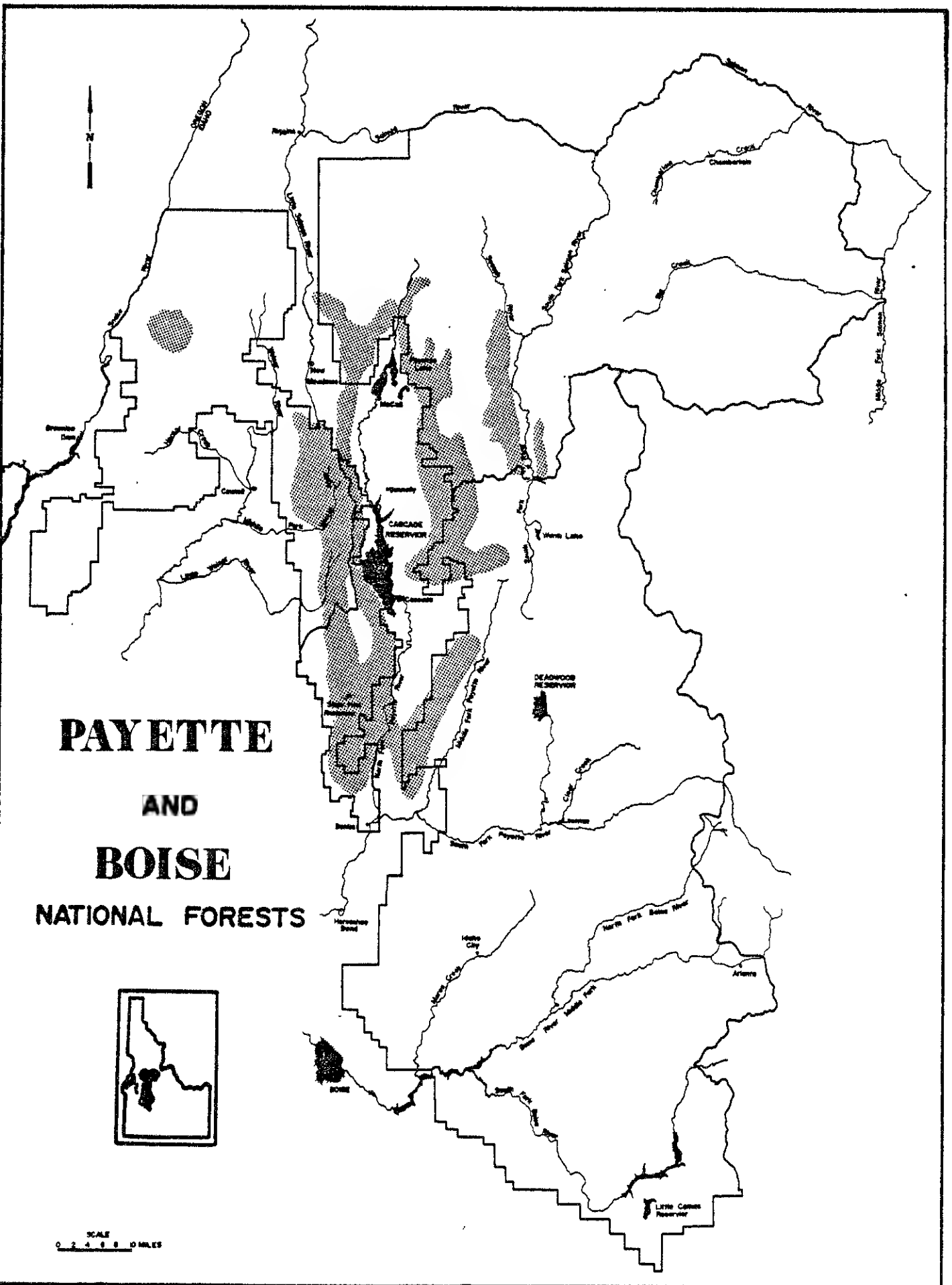
Plot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Blue Creek	1	0-25	Light
2	Dry Creek	0	0-25	Light
3	Dry Fork	No sample		
4	Jesse Creek	21	41-55	Heavy
5	Keg Creek	0	0-25	Light
6	Kelly Creek	31	41-55	Heavy
7	Lower 191	2	0-25	Light
8	Lower Dry Creek	0	0-25	Light
9	Lower Targhee Creek	3	0-25	Light
10	Lower Willow Creek	2	0-25	Light
11	Raynold's Pass	32	41-55	Heavy
12	Red Rock Pass	No sample		
13	Sawtelle Road	1	0-25	Light
14	Targhee Creed (Middle)	5	26-40	Moderate
15	Taylor Creek	0	0-25	Light
16	Timber Creek	18	41-55	Heavy
17	Twin Creek	4	26-40	Moderate
18	Upper 191	5	26-40	Moderate
19	Upper Blue Creek	2	0-25	Light
20	Upper Dry Fork	1	0-25	Light
21	Upper Kelly Creek	5	26-40	Moderate
22	Upper Red Rock Pass	1	0-25	Light
23	Upper Targhee Creek	0	0-25	Light
24	Upper Sawtelle Road	4	26-40	Moderate
25	Willow Creek	2	0-25	Light
MEAN		6.1	26-40	Moderate

WESTERN SPRUCE BUDWORM
EGG MASS SURVEY DATA
1979

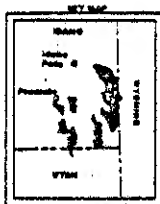
TARGHEE NF (Driggs) (Unit 5)

Plot No.	Area	No. Egg Masses/ 3 Tree Cluster	Predicted Defoliation (%) 1980	Defoliation Category
1	Lower Fleming	6	26-40	Moderate
2	Mahogany Creek	12	41-55	Heavy
3	Mike Spencer Canyon	38	41-55	Heavy
4	Porcupine	23	41-55	Heavy
5	Pole Canyon	15	41-55	Heavy
6	Ramey Canyon	3	0-25	Light
7	Squaw Canyon	27	41-55	Heavy
8	Trail Creek	43	56-100	Very Heavy
9	Upper Fleming	24	41-55	Heavy
MEAN		21.2	41-55	Heavy

APPENDIX B



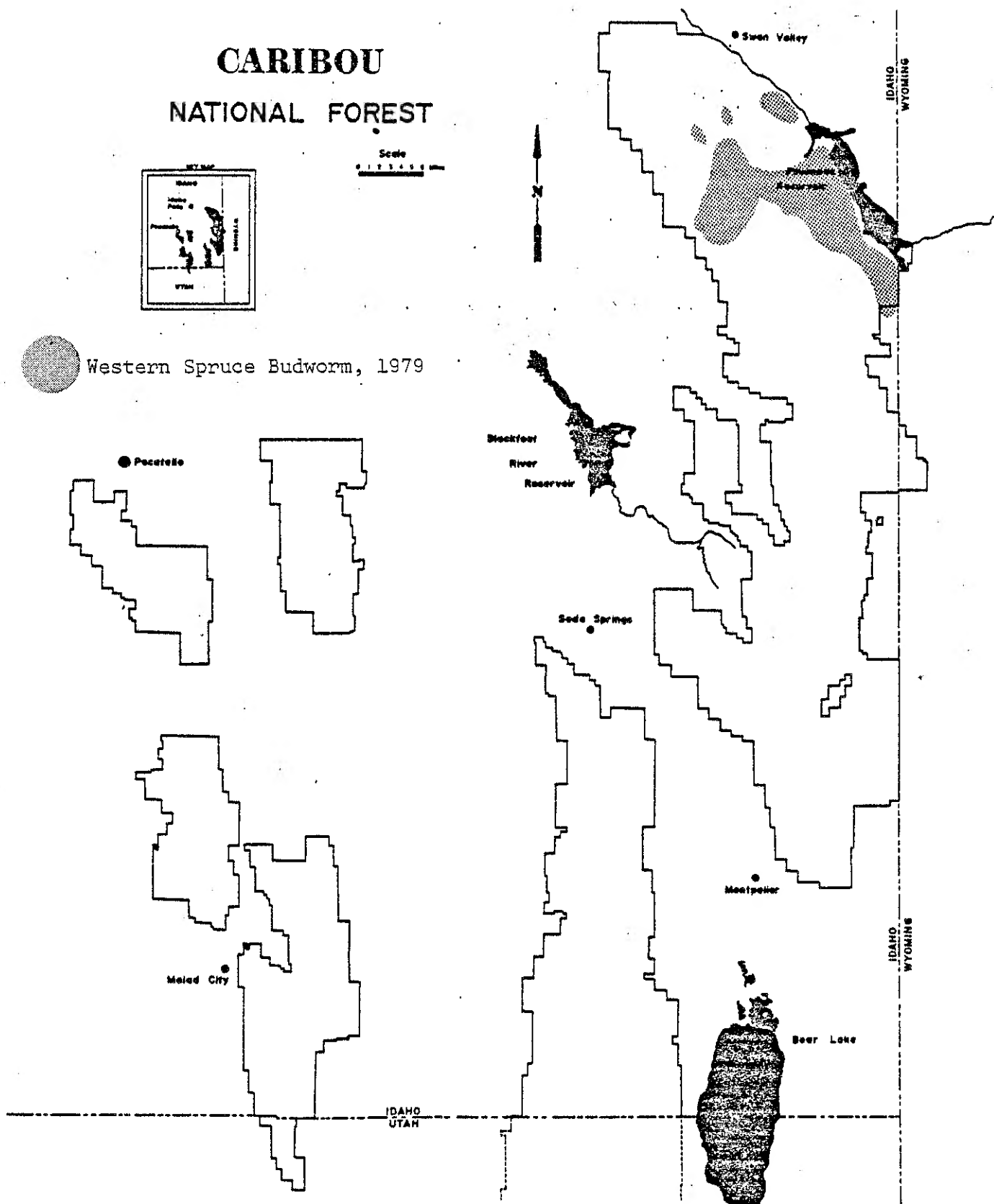
CARIBOU NATIONAL FOREST

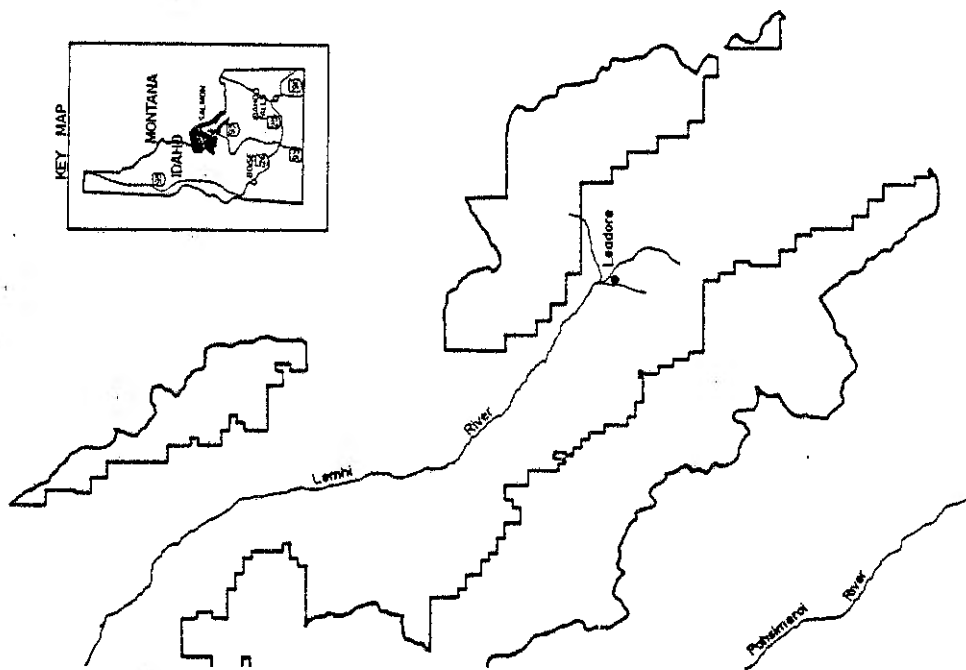
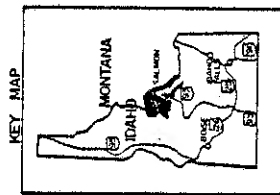


Scale
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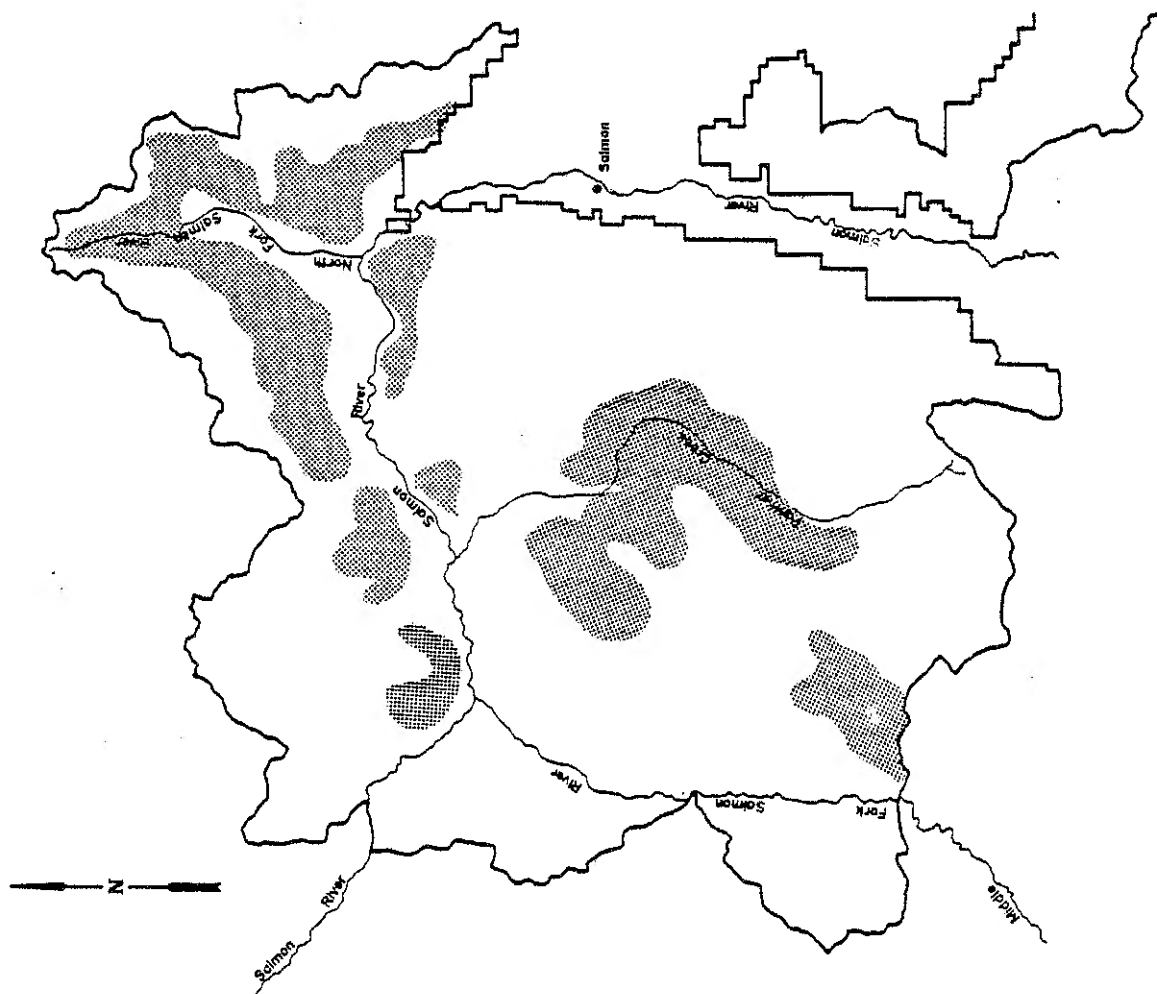
Western Spruce Budworm, 1979





SALMON NATIONAL FOREST

SCALE
0 2 4 6 8 10 MILES



Western Spruce Budworm, 1979



